INCH-POUND

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SUPERSEDING
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PERFORMANCE SPECIFICATION SHEET

ELECTRON TUBE, MAGNETRON
TYPE 8682

This specification is approved for use by all Departments and Agencies of the Department of Defense.

The requirements for acquiring the electron tube described herein shall consist of this document and the latest issue of MIL-PRF-1.

DESCRIPTION: Inverted coaxial tunable frequency, 32,900 to 33,500 MHz, 50 kW (minimum) peak power pulse type.

ABSOLUTE RATINGS:

Parameter: Unit:	Ef V	If (surge) A	tk sec	epy kv	VSWR ---	ib a	Pi W	pi kw	Du ---
Maximum: Minimum:	18 ---	15 ---	--- 300	20 ---	1.3:1 ---	20 12	200 ---	400 ---	0.0005 ---

ABSOLUTE RATINGS:

Parameter: Unit:	tpc µs	rrv kv/µs	T (anode) °C	Turner drive torque inch-ounce	Pressurization output psia
Maximum: Minimum:	2.2 0.1 6/	150 100	150 -65 3/	50 --- 2/	45 --- 4/

PHYSICAL CHARACTERISTICS:

Dimensions:	See figure 1.	Cooling:	Forced air. 8/
Mounting position:	Any.	Handling:	9/
Mounting support:	See figure 1.	Output waveguide:	WC59.
Coupling:	See figure 2. 10/	Cathode connector:	Jettron 90-006, or
Weight:	17.5 pounds (approximate) 7.94 kg.		equivalent.

TEST CONDITIONS:

Parameter: Unit:	Ef V	epy kV	VSWR ---	tk sec	ib a	Du ---	tpc µs	rrv kv/µs	T(anode) °C
Maximum: Minimum:	13.9 12.5	19 17	1.1:1 ---	--- 300	16.7 16.2	0.00042 0.00038	0.22 0.18	--- --- 6/	140 -55

Frequency	
F1	32,900 MHz
F2	33,000 MHz
F3	33,200 MHz
F4	33,400 MHz
F5	33,500 MHz

GENERAL:

Qualification - Required.

TABLE I. Testing and inspection.

Inspection	Method	Notes	Conditions	Symbol	Limits		Unit
					Min	Max	
Qualification inspection							
Temperature coefficient	4027	3/	T(anode) = 70°C to 140°C; F = F3	ΔF/ΔT	---	0.30	MHz/°C
Thermal frequency drift	4030	23/		ΔF	---	30	MHz
Variable-frequency vibration (operating)	1031	12/ 13/		---	---	---	---
Mechanical tuning range	4223	15/ 16/		---	---	---	---
Mechanical tuning fatigue	4223	20/ 21/		---	---	25,000	Cycles
Direct-interelectrode capacitance	4266	---		C	22	28	pF
Low-temperature operation	1047	18/ 19/	T(anode) = 55°C; F = F3	MP	---	0.5	%
Conformance inspection, part 1		11/					
Pressurizing	4003	25/	40 to 45 psia output assembly	---	---	---	---
Heater current, nonoperating	4289	---	Ef = 16.0 V	If	4.6	5.4	A
Tuner drive torque	4223	20/	Ambient temperature	Torque	---	5	inch-ounce
Mechanical tuning	4223	15/ 16/ 26/	T(anode) = 70°C to 110°C	F	32,900	33,500	MHz
Warmup time (heater cathode)	4303	5/		tk	300	---	sec
Pulse characteristics	4304	6/ 7/		---	---	---	---
Electrode current (anode)	1256	---	Ib = 6.5 mA dc	---	---	---	---
Power output (1)	4250	---	F = F2, F3, and F4	Po	20	30	W
Power output (2)	4250	---	F = F1 and F5	Po	16	30	W
RF bandwidth	4308	18/	F = F1 through F5	BW	---	2.4/tpc	MHz
Minor lobes	4308	18/	F = F1 through F5	Ratio	7	---	dB
Time jitter	3261	---	F = F1 through F5	tj(p-p)	---	10	ns
Stability	4315	18/	Ib = 6.5 mA dc; F = F1 through F5	MP	---	0.25	%
Pulse voltage	4306	---	F = F3	epy	17.0	19.0	kv
Electronic tuning range	4280	1/	T(anode) = 90°C	ΔF	---	±20	MHz
Resettability	4223	17/	33,200 ±50 MHz	ΔF	---	10	MHz

See footnotes at end of table.

TABLE I. Testing and inspection - Continued.

Inspection	Method	Notes	Conditions	Symbol	Limits		Unit
					Min	Max	
Conformance inspection, part 2							
Forced cooling	1143	3/ 8/ 22/		T	---	100	°C
Shock, specified pulse	1042	14/	11 G; t = 11 ms	---	---	---	---
Frequency pulling figure	4310	---	F = F3; VSWR = 1.2:1 (minimum)	ΔF	---	15	MHz
Frequency pushing figure	4311	---	ib = 14 to 16a	ΔF	---	1.0	MHz/a
Conformance inspection, part 3							
Life test	---	24/	Group D; VSWR = 1.2 minimum cycled through 2G in 15 minutes	t	1,000	---	hours
Life-test end points:	---						
Power output (1)	4250	---	F = F2, F3, and F4	Po	16	---	W
Power output (2)	4250	---	F = F1 and F5	Po	14	---	W
RF bandwidth	4308	18/	F = F1 through F5	BW	---	2.5/tpc	MHz
Minor lobes	4308	18/	F = F1 through F5	Ratio	6	---	dB
Stability	4315	18/	F = F1 through F5	MP	---	0.5	%

1/ After thermal frequency stability has been reached at each of the frequencies of this test, F1, F2, F3, F4, F5, the curve of frequency versus tuner position shall not deviate more than the amount specified herein from the tuning curve, figure 3, when turning the dial in either direction.

2/ The tuning drive to the tube's tuner shaft shall be capable of supplying a minimum of 7 inch-ounces of torque (including the inertial effects) when driven to the tube's internal mechanical stops below F1 and above F5.

3/ The temperature shall be measured at the point indicated on figure 1, only after thermal equilibrium has been reached.

4/ Pressurization of the input bushing is not required at altitudes below 10,000 feet.

5/ Prior to the application of anode voltage, the cathode shall be heated to the required initial operating temperature. This may be done by applying 16 .0 volts ±5 percent for 300 seconds minimum. Upon the application of anode voltage, the heater voltage shall be lowered to 13.2 volts ±5 percent when the tube's average current reaches 6.5 mA dc.

6/ The characteristics of the applied pulse shall be those which result in proper starting and oscillation. The rate of pulse voltage rise, the percentage of pulse voltage ripple, and the rate of pulse voltage fall are among the most important considerations. See method 4304, figure 4304-2.

tpc μs	rrv 7/ kv/μs	
	Maximum	Minimum
0.1	150	100
1.0	130	100
2.2	120	100

TABLE I. Testing and inspection - Continued.

7/ No spike or ripple shall exceed ±5 percent of the average peak value of voltage or current. The time of fall of current measured between 20 percent and 85 percent of the smooth peak value of current shall not exceed 0.05 μs. Current pulse droop shall not exceed 5 percent.

8/ An airflow of 20 cfm at 760 mmHg shall be directed on the cooling grooves.

9/ In handling and mounting the magnetron, care shall be exercised to prevent demagnetization. A minimum distance of 6 inches (152.4 mm) shall be maintained between the tube and ferromagnetic materials or energized magnets.

10/ The tube's output is circular waveguide. Transformation from circular to rectangular waveguide shall be accomplished by a mode transition. (See figure 2.)

11/ The combined sampling plan (percent defective) for conformance inspection, part 1, shall be 1.0, inspection level II.

12/ The tube shall be mounted in a resonance-free jig and vibrated while operating under the conditions specified herein in each of three mutually perpendicular planes (see figure 1) with the vibration frequency varying between 10 and 2,000 Hz at a double amplitude of 0.06 inch (1.52 mm) or 5 G, whichever is the limiting value. The rate of frequency change shall be logarithmic and shall be such that a complete cycle (10 to 2,000 to 10) will consume approximately 19 minutes. The test shall continue for 120 minutes in each of the three planes. The tube shall be operated continuously throughout the duration of the test.

13/ After subjection to the specified test, the sample shall meet all requirements of conformance inspection, part 1.

14/ The sample shall be mounted on a test plate and subjected to 18 impact shocks of the acceleration and duration specified herein. The velocity change shall not be less than 2.5 ft/sec^2. Three shocks shall be applied in each direction along each plane specified on figure 1. No physical change shall result and the sample shall meet the requirements of conformance inspection, part 1, mechanical tuning range, and resettability.

15/ Nominal tuner dial readings shall be determined corresponding to code letters specified herein (F1 through F5), and the tube shall be marked as specified on figure 1. See figure 3 for tuning curve.

16/ With the tuning dial adjusted for a frequency of F3, an operation frequency of F1 will be obtained by counter-clockwise rotation (see figure 1) of the tuning shaft 11 ± 1 turns. A frequency of F5 will be obtained by clockwise rotation of the tuning shaft 10 ± 1 turns from the F3 setting.

17/ The frequency obtained by turning the tuner to a given dial setting in one direction shall be reproducible within the limits specified herein when returning to that same setting from the opposite direction after thermal equilibrium.

18/ The rf bandwidth, minor lobes, and stability shall be within the limits specified herein when a VSWR of 1.2:1 minimum is introduced in the load at a distance of approximately 0.2 meter from the tube's output flange, the phase being adjusted for the worst spectrum and instability.

19/ Stability shall be measured in terms of the number of output pulses missing, expressed as a percentage of the number of input pulses applied during the period of observation. The missing pulses (MP) due to any causes, are considered to be missing if the rf energy is less than 70 percent of the normal energy level. The VSWR shall be adjusted to that phase producing maximum instability, and the MP counted during the last 3 minutes of a 15-minute test period.

20/ The torque required to operate the tuning shaft through the tuning range specified herein shall not exceed the maximum torque specified herein.

21/ The tuner shall operate for at least the number of cycles specified herein. The tube shall then meet all the conditions of torque, resettability, and mechanical tuning range at ambient temperature and shall not exceed amount specified herein. One cycle is defined as a complete traverse from one end of the tuning range to the other and back again.

22/ With the cooling airflow specified herein, the temperature of the anode (see figure 1) shall not exceed 80°C above the ambient temperature or the maximum specified herein.

TABLE I. Testing and inspection - Continued.

23/ The tuner dial shall be set for frequency F3. Cooling air shall be applied so that the frequency determining element temperature shall fall between 80°C and 120°C after thermal equilibrium has been reached. The tube shall then be allowed to cool with no voltages applied for at least 15 minutes before the following test. Anode voltage as specified shall be applied after 300 seconds heater warmup time. The frequency as measured at any time within a 20-minute period after application of pulse voltage shall be within the limit specified herein from the frequency after thermal equilibrium has been reached.

24/ Life-test shall be conducted in accordance with the following cycle:

Condition	Ib	Ef	Duration (minutes)
Standby	0	16.0	5
Operating	6.5	13.2	60
Off	0	0	5

The accumulation of the “on” time shall be the only time considered in determining compliance with the minimum value. The frequency shall be changed a minimum of 100 MHz every 72 hours during life test between the limits of F2 and F4.

25/ The pressure specified herein shall be supplied to the tube output. There shall be no leaks as evidenced by metered pressure fall-off, or by bubbles if the test is performed with the tube immersed in water. The time of the test shall be 1-minute minimum.

26/ Normal tube under test (TUT) operation shall be exhibited over the full frequency range from F1 through F5.

27/ Revision letters are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

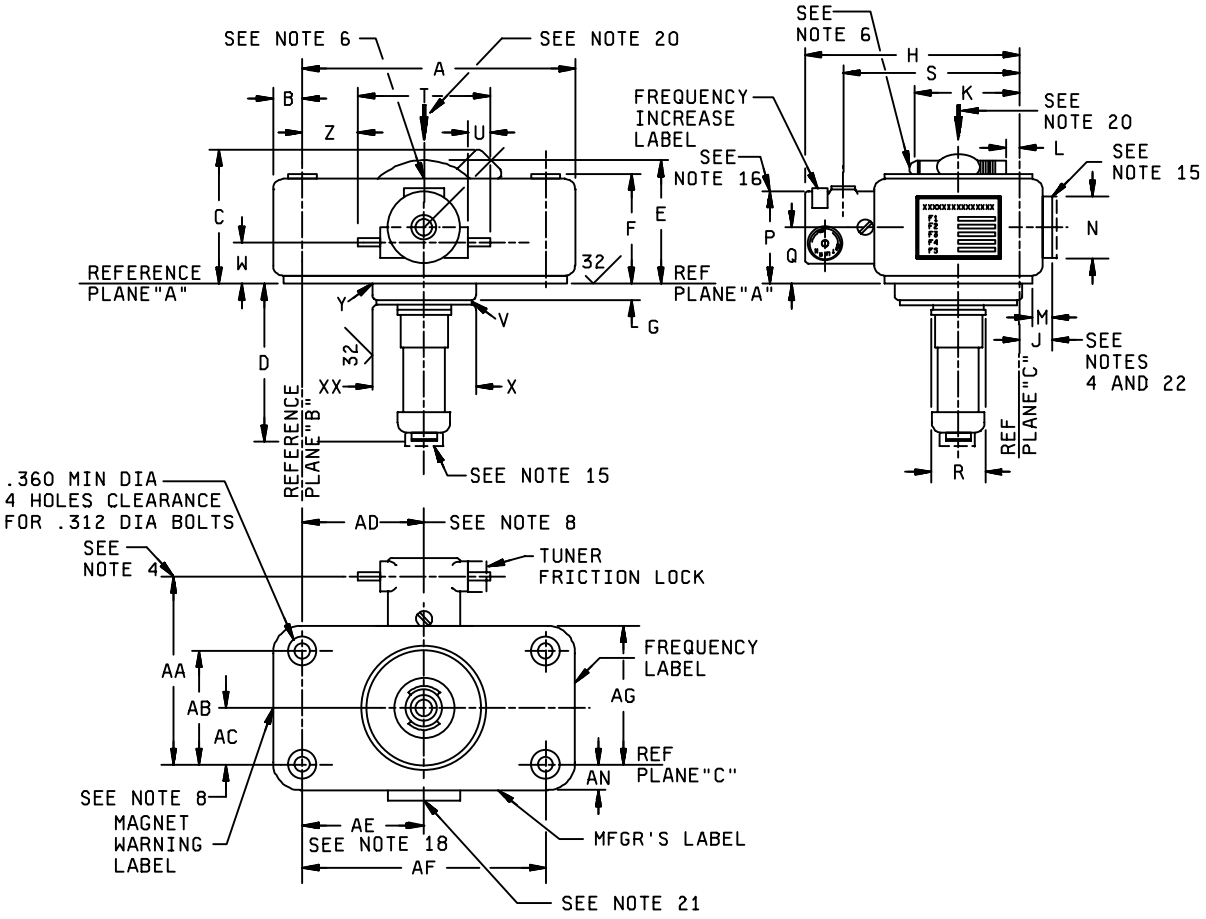

FIGURE 1. Outline drawing of electron tube type 8682.

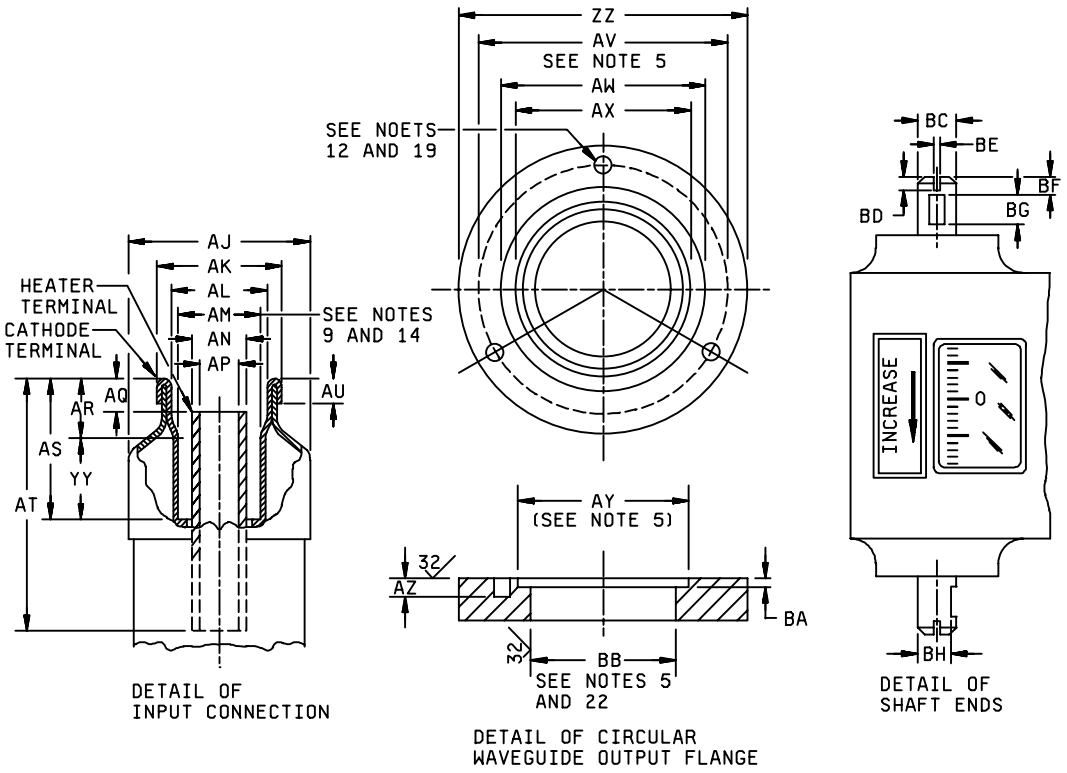

FIGURE 1. Outline drawing of electron tube type 8682 - Continued.

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
Qualification inspection				
A	---	7.750	---	196.85
B	---	.800	---	20.32
C	---	3.562	---	90.47
D	---	3.625	---	92.08
E	---	3.250	---	82.55
H	---	5.145	---	130.68
AG	---	3.437	---	87.30
AH	---	.800	---	20.32
AJ	---	1.125	---	28.58
AR	---	.200	---	5.08
AS	.562	---	14.27	---
AT	1.000	---	25.40	---
R	---	1.340	---	34.04
Conformance inspection, part 1 11/				
F	2.925	2.945	74.30	74.80
J	.875	.975	22.23	24.77
Q	1.490	1.510	37.85	38.35
U	.428	.448	10.87	11.38
W	1.070	1.194	27.18	30.33
X	2.747	2.751	69.77	69.88
AA	4.566	4.646	115.98	118.01
AB	2.618	2.632	66.50	66.85
AC	1.304	1.320	33.12	33.53
AD	3.492	3.508	88.70	89.10
AE	3.485	3.515	88.52	89.28
AF	6.990	7.010	117.55	178.05
AK	.825	.838	20.96	21.29
AL	.603	.617	15.32	15.67
AM	.532	.545	13.51	13.84
AN	.234	.266	5.94	6.76
AP	.164	.174	4.17	4.42
AQ	.125	.187	3.18	4.75
AU	.115	.135	2.92	3.43
AV	1.121	1.129	28.47	28.68
AY	.7005	.7035	17.793	17.869
BA	.024	.028	0.61	0.71
BB	.5925	.5955	15.05	15.126
BC	.1869	.1873	4.747	4.757
BD	.120	.130	3.05	3.30
BE	.038	.042	0.97	1.07

FIGURE 1. Outline drawing of electron tube type 8682 - Continued.

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
Conformance inspection, part 2				
G	.490	.510	12.45	12.95
T	3.180	3.194	80.77	81.13
Y	---	.060 RAD	---	1.52 RAD
AW	.900	.910	22.86	23.11
AX	.731	.739	18.57	18.77
AZ	.046	.054	1.17	1.37
BF	.151	.161	3.84	4.09
BG	.182	.192	4.62	4.88
BH	.153	.159	3.89	4.04
Reference dimensions				
K	2.285		58.04	
L	.235		5.97	
M	.250		6.35	
N	1.500		38.10	
P	2.500		63.50	
S	4.106		104.29	
V	.060 x 45° chamfer		1.52 x 45° chamfer	
Z	1.907		48.44	

NOTES:

1. Reference plane “A” is defined as a plane passing along the face of the mounting plate.
2. Reference plane “B” is defined as a plane perpendicular to plane “A: passing through the axis of the holes, as shown at reference plane “A”.
3. Reference plane “C” is defined as a plane mutually perpendicular to planes “A” and “B” passing through the axis of the holes, as shown at reference plane “A”.
4. Includes angular as well as lateral deviations.
5. These diameters shall be concentric within 0.002 T.I.R.
6. Anode temperature shall be measured at this point.
7. For vibration and shock testing, the planes of testing shall be reference planes “A”, “B”, and “C”.
8. This dimension applies to diameter “XX”.
9. This diameter shall be concentric with diameter “XX” within 0.030 inch.
10. Heater terminal and cathode terminal shall be concentric within 0.010 inch.
11. Input connection mates with Jettron Products, Inc. connectors, No. 90-006 and 90-030, or equivalent.
12. Four (112) - 40 NC 3 holes spaced 120°, 30’/119°, 30’ apart, by 0.250 inch deep.

FIGURE 1. Outline drawing of electron tube type 8682 - Continued.

NOTES - Continued.

13. Mates with circular waveguide, EIA designation WC-59, or equivalent.
14. This diameter applies for length of “YY”.
15. Protective closures.
16. For pressurization of the input, use an AMS 3303-148 “O” ring, or equivalent, sealed to diameter “XX”.
17. For pressurization of the output, use an AMS 3303-18 “O” ring, or equivalent.
18. Applies to diameter “ZZ” of output flange.
19. A plane passing through the axis of this hole and the axis of diameter “ZZ” shall be parallel with reference plane “B” within 0.010 inch. This hole shall be located 180° from the input connection.
20. Indicates direction of anode cooling airflow.
21. South pole.
22. This surface of the output flange shall be parallel with reference plane “C” within 0.005 T.I.R.

FIGURE 1. Outline drawing of electron tube type 8682 - Continued.

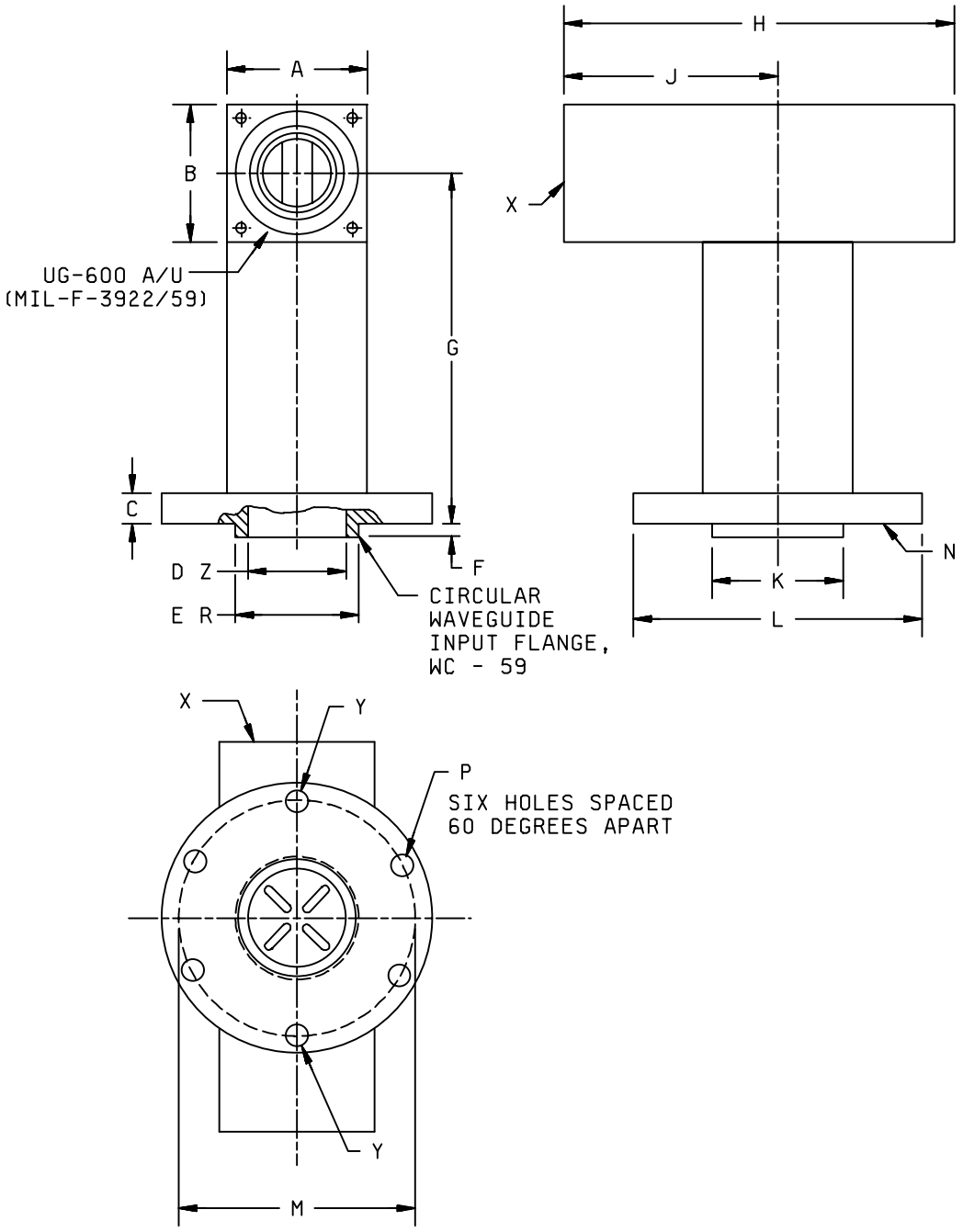

FIGURE 2. Circular to rectangular transition.

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
Qualification inspection				
A	.736	.764	18.69	19.41
B	.736	.764	18.69	19.41
C	.143	.157	3.63	3.99
H	1.673	1.687	42.49	42.85
K	.738	.762	18.75	19.35
L	1.365	1.385	34.67	35.18
M	1.122	1.128	28.50	28.65
Conformance inspection, part 1				
E	.698	.699	17.73	17.75
F	.020	.024	0.51	0.61
G	1.679	1.693	42.65	43.00
J	.891	.909	22.63	23.09
P	.120	.130	3.05	3.30
Conformance inspection, part 2				
D	.590	.602	14.99	15.29

NOTES:

1 Diameter “R” shall be concentric with reference diameter “Z” within 0.004 T.I.R.

2. Surface “N” shall be perpendicular to surface “X” within 0.010 T.I.R.

3. A plane passing through the axis of diameters “Y” at surface “N” shall be perpendicular to surface “X” within 0.010 T.I.R.

4. For pressurization of the choke flange, use an AMS 3303-13 “O” ring, or equivalent.

5. For pressurization of the circular waveguide flange, use an AMS 3303-18 “O” ring, or equivalent.

6. All surfaces other than the flange faces shall be painted semi-gloss gray conforming to FED-STD-595, color 26373.

7. Electrical parameters:

   a. Center frequency: 33.2 ± 0.3 GHz.

   b. VSWR: 1.15 (maximum) over frequency range of 32.9 to 33.5 GHz.

   c. Mode purity: 20 dB (minimum) over frequency range of 32.9 to 33.5 GHz.

   d. Pressurization: 40 psig (maximum).

   e. Power handling capability: 100 kW peak 40 watt average at 15 psig dry air.

   f. Insertion loss: 0.3 dB (maximum).

   g. Pressure leakage: There shall be no bubbles when immersed in water and pressurized up to 40 psig for 1 minute.

FIGURE 2. Circular to rectangular transition - Continued.

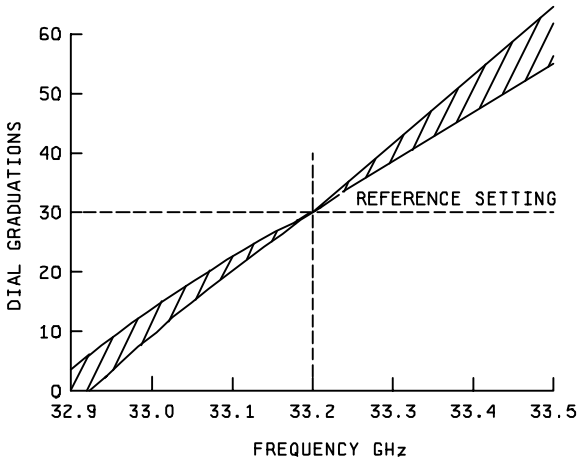

FIGURE 3. Tuning curve.

Custodians:
Navy - EC

Review activities:
Navy - AS, CG, MC, OS, SH

Preparing activity:
DLA - CC

(Project 5960-N243)